



Public policy to promote technology transfer in Chile - Licensing, technology transfer offices and technology transfer hubs

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Case study contribution to the OECD TIP Knowledge Transfer and Policies project

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Table of contents

Executive Summary	4
1. Overview.....	5
2. First stage: Technology transfer training of professionals	6
3. The Creation of OTLs.....	7
4. Recent studies about OTLs performance.....	8
5. Towards a technology transfer off campus model: Technology Transfer Hub	9
6. Possible implications for other countries.....	14
References	15

Executive Summary

Since 2011, the Ministry of Economy of Chile through Corfo -the main public agency of innovation in Chile- began to move towards an ecosystem of technology transfer, focusing firstly on strengthening human capital competencies of professionals from universities and research centers in management, commercialization and transfer of R&D results.

With professionals already trained by different international institutions, the next step since 2011 till now has been the Creation and Strengthening of Transfer and Licensing Offices (OTL) inside universities and research centers.

Given the evolution of OTLs, in 2015 Corfo decided to design and implement a specialization model of "*on campus-off campus*" functions of technology transfer, creating the "Technology Transfer Hubs" to increase the amount of technological businesses based on their research and development results and generated in universities and technological centers, and their national and international potential. This "on campus-off campus" model recognizes the necessity to continue strengthening commercialization capacities and technology transfer within the universities. It also considers moving forward in more specialized competencies to improve the probabilities of a successful global commercialization.

In 2016, three hubs composed by 26 universities, technological centers, companies, unions, angel investors' networks, investment funds of risk capital, among others actors were funded for five years.

For other countries of the continent the case of Chile can be a practical and concrete example of how through the design of bottom up public policies to promote technology transfer between the public sector and universities, especially trough offices inside universities and independent hubs outside universities, a country can advance into strengthening its technological transfer ecosystem through a model on campus-off campus. Therefore, there is a potential to move forward in the consolidation of an ecosystem of technology transfer throughout the Latin American continent working together with other countries in a continuous process of learning of the best practices.

1. Overview

In the last decade, the total public funding for main actors of the Chilean Science, Technology and Innovation System has increased. Universities remain a fundamental part of the system spending more than 38% of Chile's total investment in research and development. It is estimated that the resources spent by universities in the last 7 years exceeded US\$ 1,200,000,000 in total. This has generated an increase in scientific productivity reaching 7.900 Web of Science papers in 2014 (1.5 times more than the 5.406 papers in 2010).

Although this increase is recognized, Chile remains far away from OECD countries in R&D expenditure (while Chile invests only 0.39% of GDP in research and development, the OECD countries invest an average of 2.4%). Even more, the increase in scientific productivity is not reflected in commercialization and technology transfer indicators, for example with a low number of patent applications, licenses, and spin offs.

Undoubtedly, universities play a key role in the Chilean ecosystem as the main institutions producing knowledge. Regarding this role, several diagnoses identify the need to legitimize the "third mission", understood as the contribution to society. This is aimed to develop and strengthen the use and exploitation of knowledge outside the academic environment (World Bank, 2009, Verde, 2016).

Chilean universities have a long history of links with society and industry, which has worked mainly from a perspective of extension and social commitment (Grao et.al., 2014). Only in recent years the notion that universities can generate incomes from the commercialization of scientific-technological knowledge has been promoted, which for many universities remains as an activity that conflicts with their public mission.

In 2009 The World Bank pointed out the need to improve the regulatory-institutional framework at a national level to foster technology transfer, which was fragmented and outdated comparing to international practices.

That same year, the National Institute of Industrial Property (INAPI), under the Ministry of Economy, began its activities. Since then, INAPI's work has focused on generating "efficient systems for the use and protection of industrial property rights, promoting innovation, entrepreneurship and knowledge transfer to society" (INAPI, website).

Subsequently, important progress has been made, including the validity in Chile of the Patent Cooperation Treaty (PCT) in 2012, and the designation of INAPI as one of the 19 patent offices worldwide with PCT authority ISA/IPEA (International Searching Authority / International Preliminary Examination Authority).

2. First stage: Technology transfer training of professionals

In 2009, the World Bank's "Fostering Technology Transfer and Commercialization: Chile" report remarked Chile's need to stimulate the development of technology transfer, focusing on the following areas:

- To improve institutions, regulations and practices for an efficient and dynamic intellectual property management system.
- To develop strategic partnerships for oriented science and improvement of National Public Technological Institutes.
- To accelerate the creation of technological companies.
- To develop skills and competencies to support the above-mentioned companies.
- To stimulate the universities' "third mission" to contribute economic growth.
- To stimulate demand for technology and innovation.
- To stimulate a culture of entrepreneurship and innovation.

In each one of these areas, Chile presented gaps that must be closed in order to obtain a more efficient and effective level of technology transfer.

In response to this report and the recommendations of the OCDE (2007), Corfo -the main public agency of innovation in Chile - began to move towards an ecosystem of technology transfer focusing firstly on strengthening human capital competencies; funding the training of professionals from universities and research centers in management, commercialization and transfer of Research and Development results. The professionals were trained by the Association of Universities Technology Managers (AUTM) of USA.

That same year, a group of Chilean professionals created RedGT (Network of Technological Managers). This initiative was driven by the need of these professionals to coordinate themselves on topics related to technology transfer. RedGT's mission is to develop crosscutting actions that promote technology transfer in Chile, being a valid actor connecting university, companies and public sector. Its vision is to become a national and international reference in technology transfer.

In the same way, through the "Go to Market" program, Corfo supported the commercialization of research and development results and Chilean technologies in global markets. This program included the participation of international entities in technology transfer, which supported the process of linking and commercialization of research and development results in global markets.

Parallel to this initiative, Corfo carried out the Technologies with Commercialization Potential Portfolio program in 2012, whose beneficiaries were technological centers, universities and technological institutes as well as companies. In this program, the beneficiary had to contract a foreign training entity to support the process of technology transfer and commercialization of research and development results. It was developed in collaboration with the Stanford Research Institute (SRI).

According to Corfo (2013), the professionals supported in training of technology transfer between 2012-2013 were 171.

3. The creation of transfer and licencing offices (OTLs)

Having already funded the training of professionals, in 2011 Corfo launched the first Program for the Creation and Strengthening of Transfer and Licensing Offices (OTL). This program was addressed to universities and National technology centers. 18 projects were supported including 21 institutions (3 associative projects).

As a result of the program, between 2012-2013 all the OTLs developed: new policies, procedures and regulations of intellectual property; new information systems; an international benchmarking; and a work plan for 5 years.

The budget of this program was US\$3.600 millions for 18 projects. Even though this budget was very helpful for a starting point of the OTLs, it was not enough to keep a foundation structure of the offices focused on a sustainable model of financing.

Posteriorly, in 2014 CORFO launched a second Program to strengthen OTLs, which aimed to support the consolidation and positioning of the offices. With this new program, it was expected to increase the number of technologies with market potential, disclosures, research and development contracts, licenses, consultancies and collaborative research with companies. Through this Program 15 OTLs were funded.

In the same year, Corfo launched the Program for Strengthening Human Capital in Technology Transfer. This program allowed researchers, professionals, technicians, and regular postgraduate students, to hire a foreign training entity.

Even though an important number of professionals were trained by foreign experts in the first Program, the result was not satisfactory at all. This was due to the fact that the reality in which experts work was very different from the Chilean one. Consequently, Corfo maintained international experts in the second program, but this time they were previously evaluated.

Through this tender, Corfo supported the training of 211 people, in subjects such as research and development contracts, licenses, spin-offs and entrepreneurship. Finally, with the objective of creating new OTLs and consolidating existing ones, in 2015 Corfo held a third tender and started a new stage supporting technology transfer programs, with a specialization model of "*on campus-off campus*" functions. It recognizes the need to continue supporting OTLs capacities as well as to support more specialized skills to improve the commercialization of technologies with global projection. (the off-campus component will be discussed further in Section V)

The *on campus* part of the model consists in the consolidation of existing OTLs. Among the promoted functions were the identification and collection of research and development results (scouting); and the fostering of a culture which strengthens a research oriented to solve problems and cover the needs of the productive sector and society.

The specific objectives are:

- To implement a 5 year strategic development plan for each OTL.
- To position the OTL within the university or technology center and in the national ecosystem.
- To increase the linkage of the OTL with researchers.
- To have a systematic methodology for the design of portfolios of technologies with market potential and business plans.

- To increase the commercialization of results from research and development.
- To increase the creation of spin offs

Finally the expected results are:

- An increasing number of licensing agreements.
- A definition of procedures and processes of technology management
- Good practices with international standards in licensing and research and development contracts.
- An improvement of portfolios with marketable technologies.

Current OTLs projects will conclude in 2018 and Corfo will continue to support OTLs as part of the on-campus model from 2018 to 2020.

4. Recent studies about OTLs' performance

In 2016, the Innovation Division of the Chilean Ministry of Economy tendered the Qualitative Study about the current state of Technology Transfer in Chile (<http://ctie.economia.cl/wp-content/uploads/2017/08/Estudio-cualitativo-TT-en-Chile-2016.pdf>). The tender aimed to collect information on the perception of public and private actors about the development of technology transfer in Chile, identifying limitations and strengths to propose recommendations for public policy.

From this study and after 4 years of Corfo supporting OTLs, it is important to share some insights about the performance of OTLs:

- University authorities and OTLs professionals declare that offices have become much better known inside universities.
- Particularly in research centers and small universities, OTLs are valued for the great support they provide to researchers.
- In terms of technology management issues, most of OTLs have achieved the committed indicators and goals, e.g. the design of policies or intellectual property regulations; preparation or updating of regulations. They have also carried out activities to evaluate research results in order to know the potential of appropriability and commercialization in a preliminary way. This is implemented by proposing and assisting in the hiring of external consultants specializing in the subject.
- One of the most important activities has been the development of technology portfolios, standing out as an advance for OTLs. However, the portfolio has not generated the expected result, since companies do not use it to search for technological solutions.
- A critical point is the technological scouting in universities and research centers with low productivity of research results. In these institutions, OTLs must invest more time searching transferable results and often with researchers without interest in technology transfer. In institutions doing more research, this task has been

focused on academics who are much more motivated and interested in the impact of their research.

- The kind of relationship between OTL and its host affects technology transfer, especially in more complex universities. In complex universities, with some degree of internal autonomy and problems of coordination, the OTL's work is harder. Even in one of the analyzed cases in the study, some Faculties also perform same tasks as the OTL, generating criticism for the excessive institutional centralization in the offices.
- OTLs have contributed to change the incentives for researchers to become more involved in technology transfer activities. Historically researchers have little valued patents as a technology transfer mechanism. Yet this reality has begun to change gradually in some universities and research and development centers. In addition, the incentive that establishes the participation of academics in some percentage of the profit of the research commercialization also contributes to the researchers' participation.
- Regarding the commercialization of research results, OTLs managers report a great diversity of realities and results, depending on the degree of maturity of the OTL and its team. In some cases there is a great progress, and in others it has been weak. Bigger gaps are found: in the phase of the TT process; the lack of TT team's experience; and the high costs of hiring external brokers. Although many of the interviewees have obtained patents, few of them claim to be successful in commercialization.
- Many OTL managers share the perception that, over time, these offices should tend to self-sustain economically.

The study also revealed some challenges for the OTLs as regards their future performance:

- A pending task in many institutions is having a policy which regulates conflicts of interest and projects with technological base as well as standardized contracts for technology transfer.
- In regards to the latter, there is a challenge to ensure the legitimacy of the rules within the academic community. In order to achieve this, a discussion is needed in which all the administrative and academic representatives of the research institutions can participate.
- In the majority of the university and research centers' OTLs weaknesses can be observed as regards their capacities for negotiating and commercializing research products.

5. Towards an off campus model: Technology transfer hubs

Considering the outcomes of the OTLs' funding between 2012 and 2014 it was possible to increase the effort of technology transfers, generating 220 disclosures and 66 new patent applications. Notwithstanding this improvement evidence, there are still few results commercialized effectively.

As a result of insufficient commercialisation, Corfo opened the “Technology Transfer Hub” program in 2015. This program aims to increase the amount of technological businesses based on their research and development results and generated in universities and technological centers, and their national and international potential. It also aims to increase the productivity and diversification of the Chilean economy by means of the creation of Technology Transfer Hubs.

These hubs are associative organizations gathering a number of 26 universities, technological centers, companies, unions, angel investors’ networks, investment funds of risk capital, among others. In addition to OTLs, the hubs must perform off campus functions, e.g. technological surveillance and competitive intelligence; intellectual property management; license commercialization; and creation and assistance to spin-offs. It also involves filling gaps of capacities required by the OTLs by means of their own tasks or the coordination and intermediation of external services (Corfo, 2015).

When analyzing the international picture -such as New Zealand (Uniservices and KiwiNet), Portugal (UTEN), France (SATT), Canada (NCE-KM) and the United Kingdom (N8)- the development of an associative model of technology transfer can be proved. Many universities and scientific-technological centers unite to put forward a common project of technology commercialization based on research and development.

The various associative models are based on coincident diagnoses with the Chilean reality. They focus on the necessity to have a critical mass of research and development, and specialists inside and outside of universities and scientific-technological centers. Thus technology transfer associative entities have been formed with public funding (France, Portugal, and Canada) and resources from the institutions generators of research and development (New Zealand and Australia).

Additionally to the critical mass, the analysis of the international experience shows the need for sectoral specialization to find synergies and human capital with experience in technology transfer to specific industries. On the other hand, developing capacities along the territory is another relevant element of the international experience. In this sense, France chose an association model by territorial areas.

Moreover, the analyzed international experience delineates the specialization of functions within the institutions which generate research and development and the associative entity formed for the technology transfer. This allows to define roles and functions clearly for each of the actors participating in the associative model.

5.1. Orientation principles in the design of technology transfer hubs

While in the last 5 years many advances have been achieved in the capacities of technology transfer -justified by the increase in the number of disclosures, patents and licenses- some gaps still remain among those which were identified in 2009:

1. Insufficient critical mass of applied research and development: the volume of basal research and development available for institutions in Chile is under the level which allows to have a constant flow of projects with potential to be developed as business with technological base. The size of the national institutions and the research level generated by them hinder the achievement of an efficient scale for transference and commercialization.
2. Only a small amount of applied research and development is of commercial interest: Universities and scientific-technological centers do research and development mainly in order to generate knowledge and, to a less extent, as a specific demand from the productive

and/or social sector. Only 4.4% of the budget destined for research and development comes from productive companies (Minecon, 2013). In other words, the majority of the research is science/ technology push, and not market pull. Nevertheless, it has been recognized that a strategy more oriented to promote market pull may have benefits related to a higher efficiency of private resources leverage. This is the result of an increase in the original product demand and/or services involved; at least in some of the sectors.

3. There are still limited technical competencies for technology transfer: Despite the advance in the creation and strengthening of human capital in the matter, highly technically experienced professionals are needed. The areas where these professionals are required are research, intellectual property, business scaling as well as technologically based entrepreneurial projects directed to national and international markets. In addition to these professionals, great networks of funding and investment are also needed.

In order to ensure that the competencies are reinforced in those key fields for the development of the country, the technology transfer HUBs will have to focus primarily in the sectors where research and development are carried out in Chile.

According to the NABS classification (Nomenclature for the Analysis and Comparison of Scientific Budgets and Programmes, OECD, 2007), these sectors are: agriculture (including aquaculture); health; industrial production; technology; and energy. They were selected due to the fact that they concentrated 82% of the applied research and development carried with public funding in 2014 in Chile.

Additionally, in order to guarantee the coverage of the technology transfer capacities in the territory, the formation of HUBs will have to consider an appropriate coverage of regional entities dedicated to research and development. Based on these design criteria, the formation of a HUB must fulfill the following lineaments:

- Ensuring a minimal critical mass of applied research and development in the country.
- Achieving specialization in priority sectors which carry out research and development and a minimal volume of their products.
- Ensuring regional representation for an appropriate national coverage as regards the number of participants and research and development number.
- Having a minimum of participants

The main objective of the technology transfer hubs is to increase the amount of technological businesses based on the results generated by research and development, and their national and international projection. The results are generated by universities, and national technological centers to increase productivity and diversification of the Chilean economy.

The specific objectives are:

- To implement an associative model with function specialization on campus-off campus which achieves the necessary scale for the HUBs' sustainability in the near and distant future.
- To attract and generate specialized human capital in intellectual property management, technology transfer and models of linkage with the industry, such as technological contracts, open innovation, among others.

- To improve the market potential of the technological actives generated by the research and development projects, adopting the best international practices in technological management.
- To increase the creation of entrepreneurial projects with technological base from the results of research and development; and the amount of private invested resources, boosting the access to a risk capital in early stages nationally and internationally.
- To strengthen the positioning of the on campus off campus technology transfer entities in the national innovation and entrepreneurship ecosystem.

The expected results of this new program are:

- The HUB's strategic development program of 10 years which considers an administration and business model which allow the achievement of its objectives and sustainability.
- The implementation of an associative model with specialization of on campus off campus functions
- An increase in the quantity and quality of the actors' competencies of the system of innovation in industrial and intellectual property management; in technology transfer and of the links with the industry and in open innovation.
- An increase in the value of technological actives and innovations portfolio, improving the disclosure, intellectual and industrial management, and the new technological business with global focus.
- An increase in the number and amounts of the applied research and development contracts made by universities and companies; licenses and collaboration projects between university and company in strategic sectors of high impact.
- An increase in the commercialization of Chilean technologies abroad.
- An increase in the number of spin-offs and entrepreneurial projects of technological base.
- An increase in the number of spin-offs of technological base which obtain funding for their scaling.

So as to fund the hubs, Corfo launched a tender in 2015 to grant a subsidy of an 80% of the project's total cost, with a maximum of US\$ 8.000.000 (eight million dollars for 5 years).

The provisional recipient has been defined as the profit or nonprofit legal, public, or private person constituted in Chile who receives the subsidy temporarily, waiting for the constitution or selection of the definite recipient.

The recipients must be Universities, Professional Institutes and National Scientific-Technological centers. Their participation will also give appropriateness to the project.

The duration of the projects must be a maximum of 5 (five) years, renewable for a maximum of 16 (sixteen) months after the decision of Corfo; or by a justified request by the recipient prior to the original deadline.

The projects were selected after an international evaluation with external evaluators. After that, an internal committee in Corfo reviewed the proposals, the international evaluation and decided to fund the 3 proposed projects: HUBTEC CHile, KNOWHUB and APTA (Andes

Pacific Technology Access), which prioritarily focused on agriculture; health; industrial production, technology and energy. Each Hub is working in the same areas and is composed by a group of universities, companies, research centers and technological centers.

The “on campus-off campus” model (illustrated in Figure 1) recognizes the necessity to continue strengthening commercialization capacities and technology transfer within the universities. It also considers moving forward in more specialized competencies to improve the probabilities of a successful global commercialization.

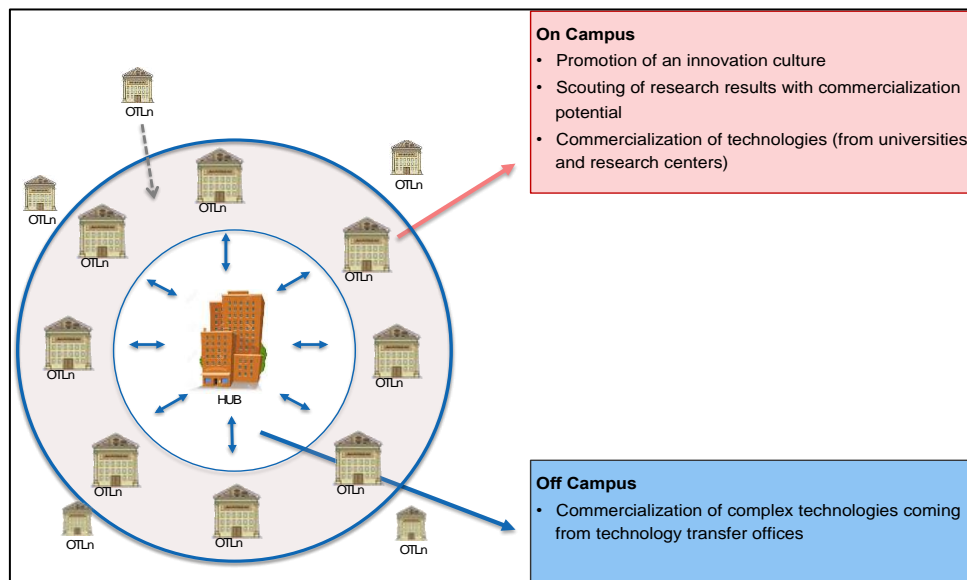
- The on campus component refers to the current OTLs’ roles linked to the identification and active recollection (scouting) of the research and development results in universities, scientific-technological centers or other institutions generating knowledge. It also entails to promote a culture which boosts research “with a purpose”-more oriented to solve problems and give solutions to the needs of the productive sector and society.
- The off campus component refers to the work of an entity which has capacities and highly specialized human capital for the scaling and technology transfer of the results of research and development of universities, scientific-technological centers or other institutions generating knowledge. It is oriented to the creation of businesses in different industries in global markets with access to networks of support in the internationalization of entrepreneurial projects of technological base. This task is done in accordance to the extent and operation rules which define their component members. It also involves the task of filling capacity gaps required by OTLs by means of their own tasks, or through coordination and intermediation of external services.

Even though this model has been implementing since 2016 one of the main potential risks could related with probable tensions between OTLs and Hubs, given the selection criteria that hubs have for the commercialization of technologies, which may influence the OTL to decide to commercialize by itself. This tension can occur above all for those universities with capacities for commercialization where the decision to commercialize through the OTL or the Hub is more complex.

Finally, the on-off model of technology transfer is illustrated in Figure 1, with Chilean technology transfer offices inside universities and research centers working on scouting of research results with commercialization potential and the hubs focused specifically on commercialization and creating new technological businesses.

To date, Corfo is supporting three technology transfer hubs and 29 offices of transfer and licensing. In their first year, the hubs have designed their own administration, business models, and intellectual property policies. These advances will conclude with their application to legal entities and being independent from universities and research centers. Shortly they will start contracting the main management teams.

Figure 1. On campus - off campus model of technology transfer



Source: Corfo, 2016

6. Possible implications for other countries

Given the participation of Chile in the Pacific Alliance, particularly in the Technical Innovation Group, it should be noted that technology transfer is one of the issues that have been prioritized in a public-private agenda. Together with the Inter-American Development Bank (IDB), the Group is currently developing the project “Fostering the technology transfer in Pacific Alliance countries”.

This is due to the promotion of training of professionals in technological management, collaborative technological development, and generation of networks among the different actors of the Pacific Alliance ecosystem through the Business Accelerators Network (AcelerAP), Angel Investors (AngelesAP), Network of Innovation Agencies (InnovAP), and the future Network of technology transfer offices (TechTransferAP). Especially through a joint work of technology transfer offices of PA countries the project aims to promote the transfer of technologies between the countries allowing both established companies and Start-Ups the absorption, use and commercialization of technologies in a cross-border way.

Notwithstanding the above, for other countries of the continent the case of Chile can be a practical and concrete example of how through the design of bottom up public policies to promote technology transfer, especially through offices inside universities and independent hubs outside universities and with Corfo accompanying them and help them to achieve their objectives, a country can advance into strengthening its technological transfer ecosystem through a model on campus-off campus. Therefore, there is a potential to move forward in the consolidation of an ecosystem of technology transfer throughout the Latin American continent working together with other countries in a continuous process of learning of the best practices.

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